



# **Super Energy Efficient Containerized Living Unit (SuperCLU) Technology Design and Development**

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# **Super Energy Efficient Containerized Living Unit (SuperCLU) Project**



## **Two Phases:**

- **Modify Existing CLUs at Camp Lemonnier**
- **Design/Build SuperCLU Prototype**

# Camp Lemonnier, Djibouti



## U.S. AFRICA COMMAND COMBINED JOINT TASK FORCE–HORN OF AFRICA

**Mission: Conduct operations in the East Africa region to build partner nation capacity in order to promote regional security and stability, prevent conflict, and protect US and coalition interests.**



# Camp Lemonnier, Djibouti



- **Harsh Environment**

- Average Daytime Temperature (77 to 111 °F in 2010), can reach 125 °F during the day
- High Humidity (Average Dew point was 72 °F in 2010)
- Average wind flow 8 mph (gusts up to 34 mph)

- **Personnel are Quartered in Containerized Living Units (CLUs)**

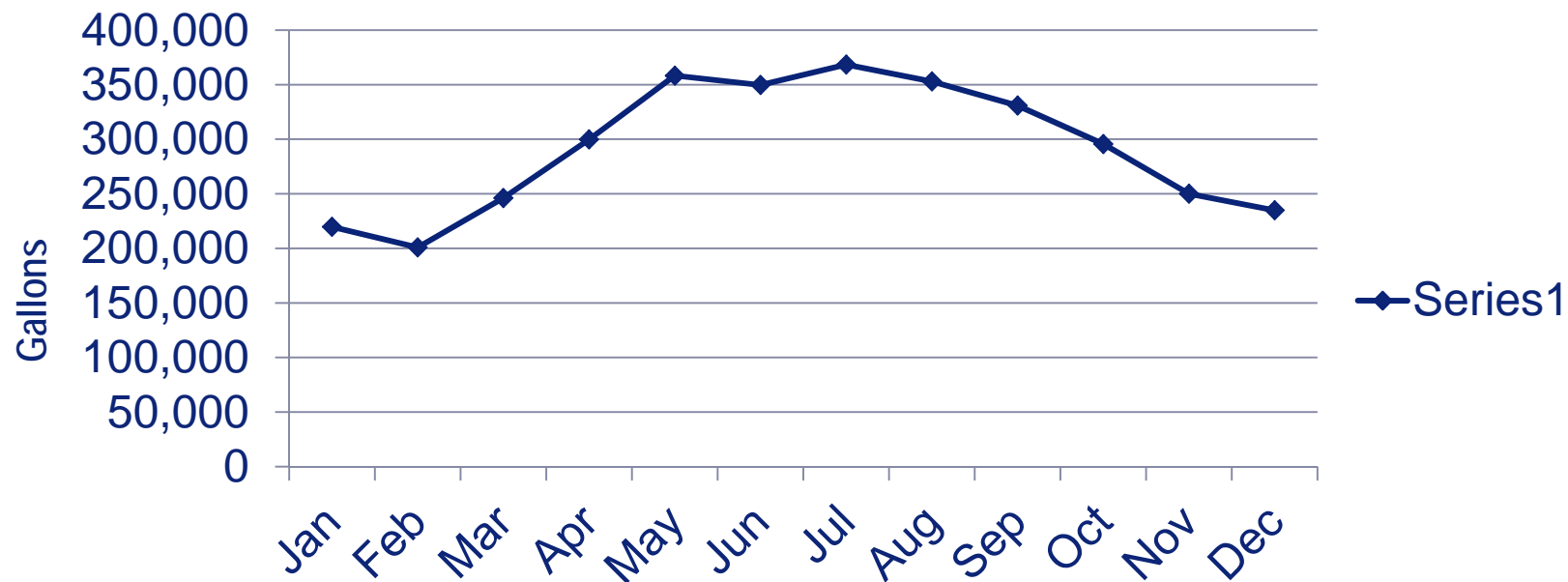
- **Increasing Population**

- Personnel at times Outnumbers available CLUs

# Camp Lemonnier, Djibouti



- **Energy Production comes from Diesel Power Generators**
  - Generators run 24/7 (8 x 1.3 MW Caterpillars, 6 x 0.8 MW MUSE, 130-140 smaller generators)
  - Approximately 11,000 gallons of diesel fuel is required to run the generators daily (2010)
  - Estimated monthly cost for fuel is \$600K-1000K (\$3 per gallon)





# Camp Lemonnier, Djibouti



**CLUs Current Condition uses  
40% of Estimated Base Load**



# Camp Lemonnier, Djibouti



## CLUs Current Condition

- Poor Air Distribution
- Large Difference in Air Temperature down length of CLU
- Oversized ACUs Cycle On and Off every 3-4 Minutes





# SuperCLU Program Goals



- **Reduce Energy Load for CLU**
- **Easy Set Up and Tear Down (One Day/2 Person)**
- **Maintain Ability to be transported as a ISO container**
- **Create Private Resting Space**

# Camp Lemonnier, Djibouti



## **CLU Constraints**

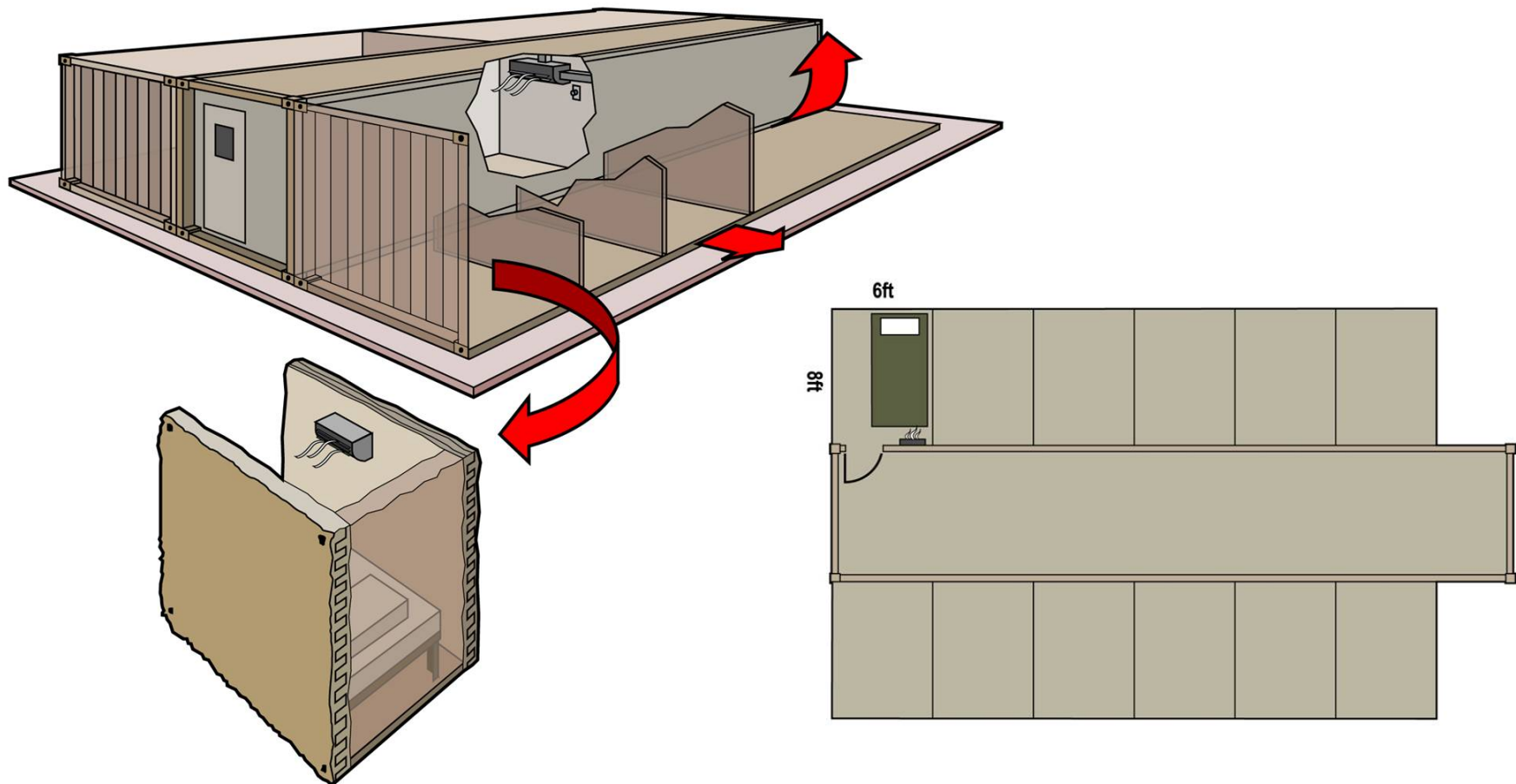
- **Limited downtime during repair**
- **No displacement of occupants**
  - Work should only be done that can be completed during the day,
  - While occupants are away from CLUs,
  - Should not disrupt sleeping hours.
- **Modifications should not limit CLU mobility in the camp**
  - System installed needs to be able to be broken down fairly quickly

# SuperCLU Energy Reduction Innovation Areas



- **Layout**
  - Increase People Housed per CLU
  - Reduce Cubic Feet of Conditioned Air
  - Enhance Individual Space (Individual Berthing Spaces)
- **Air Conditioning**
  - Type
  - Distribution
- **Insulation Material (Walls, Floor, and Ceiling)**
- **Rigid Building Material**
- **Building Component Connections**
  - No Heat Loss
- **Coatings**
- **Interior Design Improvement**

# SuperCLU Concept



# Testing/Prototype Schedule

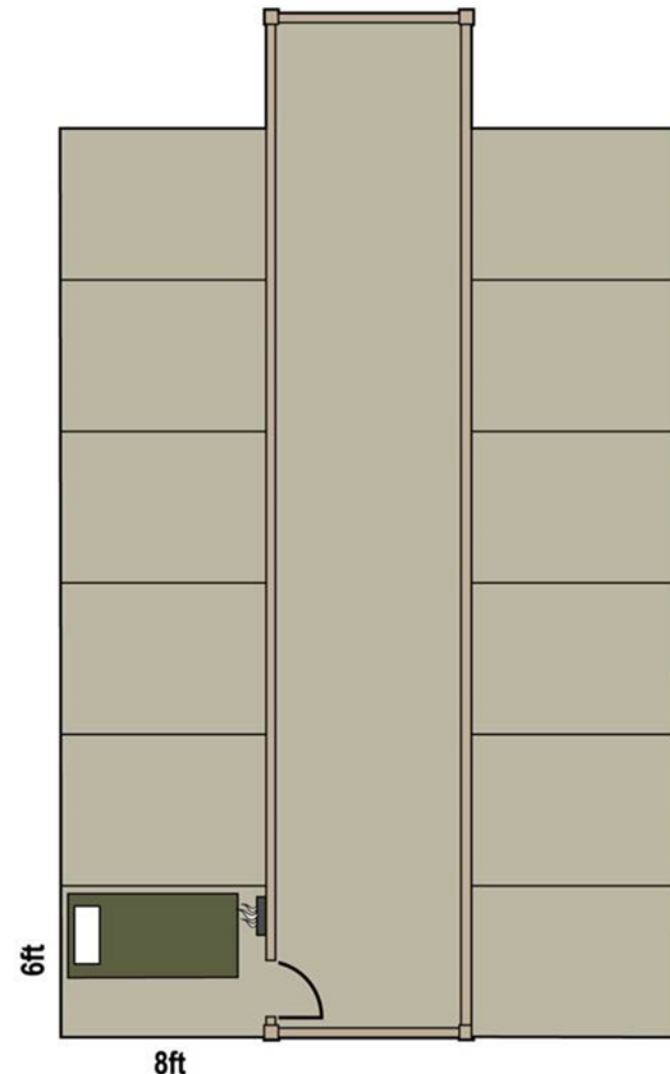


<i>Technical Test Event</i>	<i>Location</i>	<i>Timeframe</i>
Insulation Component • Thermal performance, durability, flame resistance, physical properties	TBD, RFI	3-4Q12
Building Component Seal (Thermal)	TBD, RFI	3-4Q12
Building Layout Design	NFESC, Port Hueneme	3-4Q12
HVAC Computer Model	NFESC, Port Hueneme	3-4Q12
Build Prototypes	TBD, RFI	2-3Q13
<i>Relevant Environment Test Event</i>	<i>Location</i>	<i>Timeframe</i>
Various Trial SuperCLU Field Tests (Energy, Temperature, Human Factors)	WARTEC, 29 Palms CA	3-4Q13
SuperCLU Field Test OCONUS (Energy, Temperature, Human Factors)	Camp Lemonier, Djibouti	2Q14

# SuperCLU Innovation Areas



- **Layout**
  - Increase People Housed per CLU
  - Reduce Cubic Feet of Conditioned Air
  - Enhance Individual Space (Individual Berthing Spaces)
  - Flexible Design
    - Different Size Space Options

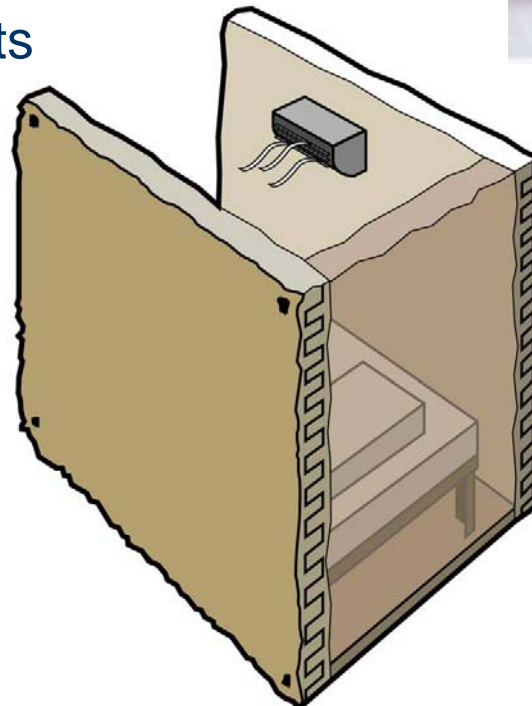




# SuperCLU Innovation Areas



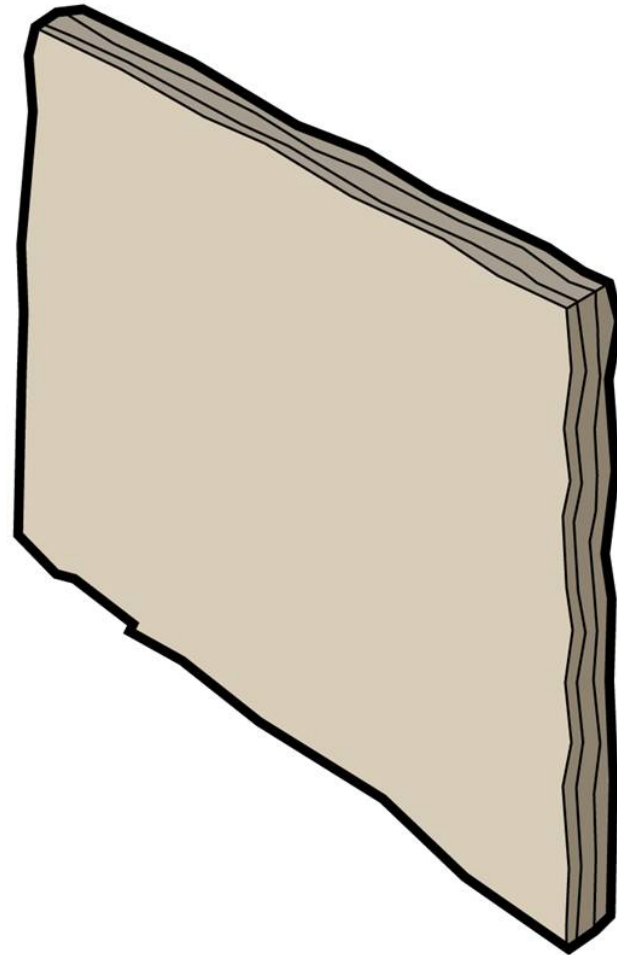
- **Air Conditioning**
  - Type is Dependant on Layout
    - Split System
    - Individual AC Units
  - **Distribution**
    - Ducted
    - Dustless



# SuperCLU Innovation Areas



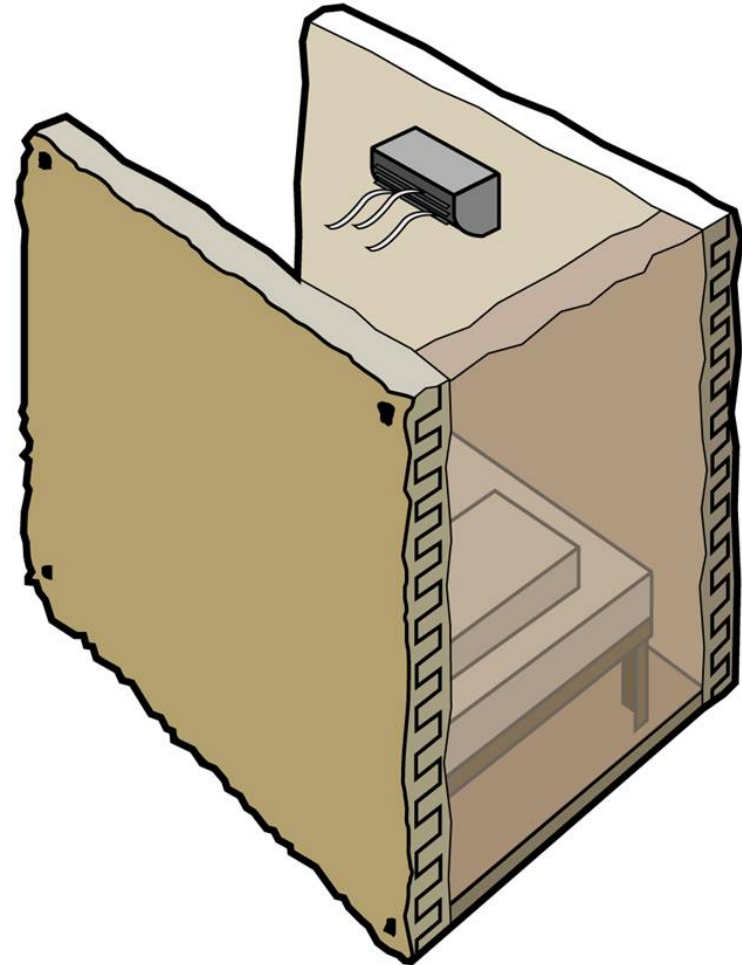
- **Insulation Material**
  - Walls
  - Floor
  - Ceiling
  - High “R” Value



# SuperCLU Innovation Areas



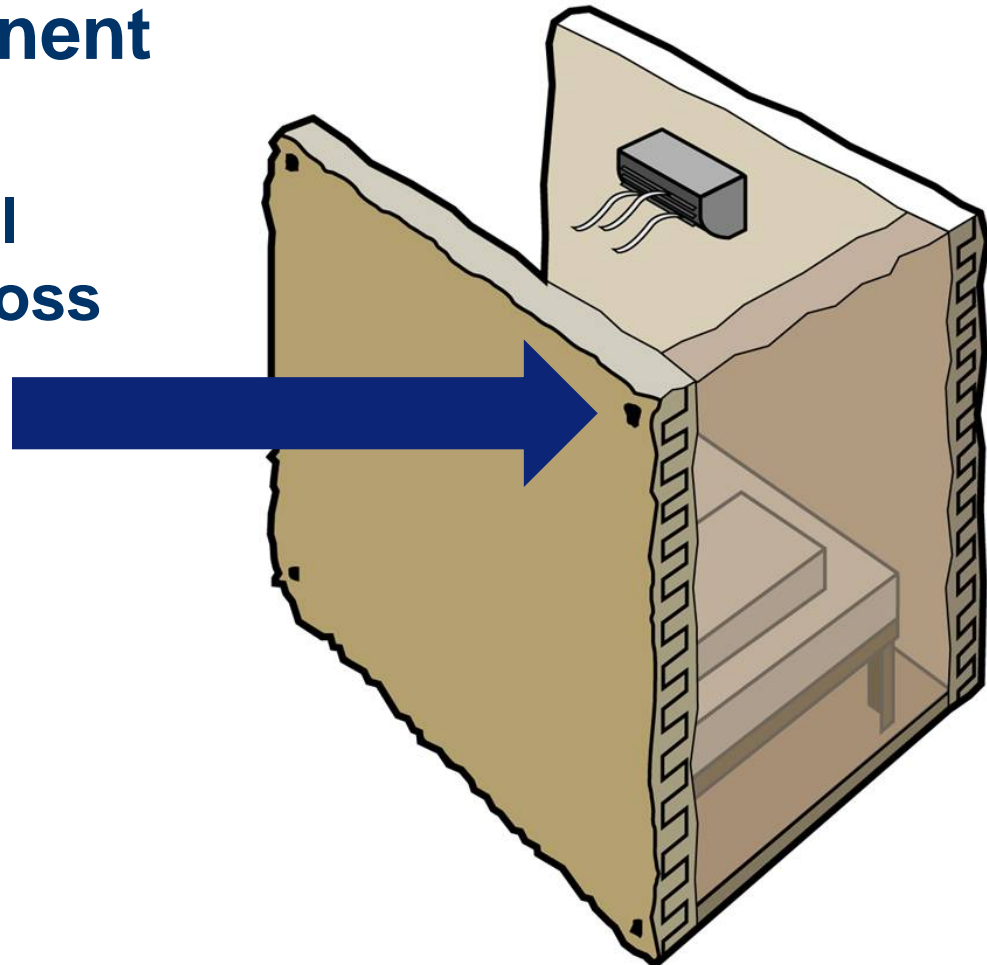
- **Rigid Building Material**
- **Incorporate Insulation**



# SuperCLU Innovation Areas



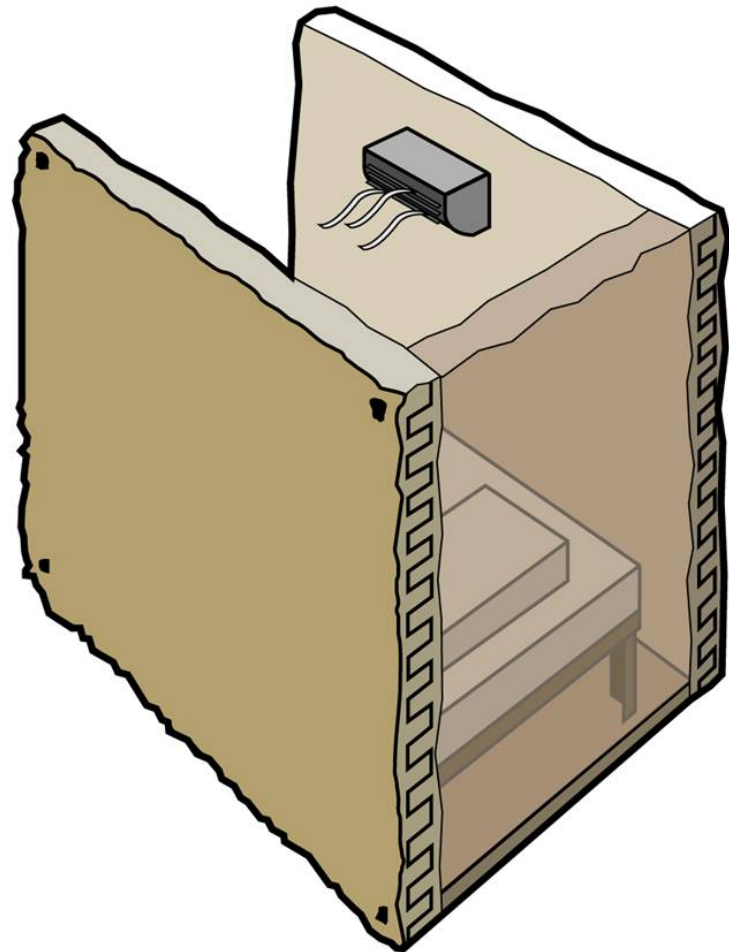
- **Building Component Connections**
  - Reduce Thermal Infiltration and Loss



# SuperCLU Innovation Areas



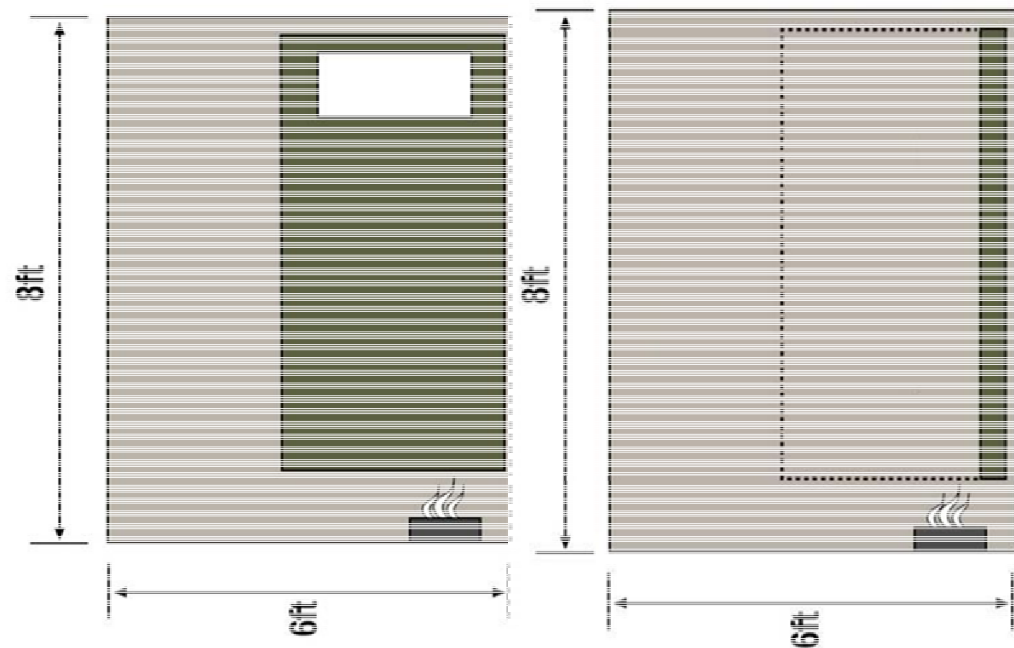
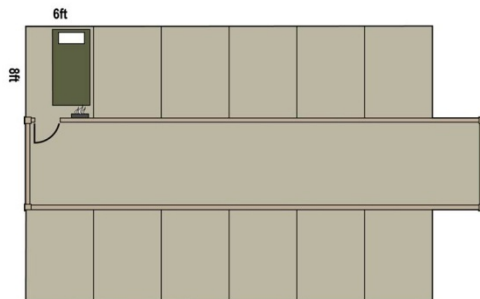
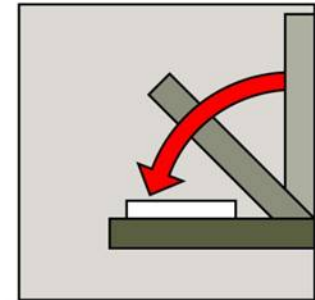
- **Coatings**
  - External
  - Internal



# SuperCLU Innovation Areas



- **Interior Design Improvement**
  - Individual Sleeping Space
  - Storage
  - Work Space





# Team Members



- **NAVFAC Engineering Service Center**
  - Dave Chavez, Team Lead
  - Robert Schoff
  - Lawrence Batch
  - Lisa Rotty
  - Chris Leksono
- **Camp Lemonnier Public Works**
  - CEC USN LT. Michelle Caponigro
  - CEC (SCW/SW) Rajon Martin

## Contact Information



**The BAA page on the NAVFAC portal (see below link) has been updated to reflect the FY12 Solicitation (#N62583-12-R-0716).**

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# QUESTIONS?